

REMARKS

Applicants respectfully request that the Examiner enter the claim amendments to place the claims in better condition for appeal. The claims were amended only to overcome the claim objections and the rejections under U.S.C. § 112, second paragraph, and to correct typographical errors. The claim amendments do not generate new issues requiring a search.

Applicants have amended claims 1, 3, 6-7, 17, 19-20, 22, 25, and 28, and have canceled claims 2, 5, 10, 12-16, 18, and 21 during prosecution of this patent application. Applicants are not conceding in this patent application that said amended and canceled claims are not patentable over the art cited by the Examiner, since the claim amendments and cancellations are only for facilitating expeditious prosecution of this patent application. Applicants respectfully reserve the right to pursue said amended and canceled claims, and other claims, in one or more continuations and/or divisional patent applications.

The Examiner objected to claims 21, 22, 25 and 28 under 37 CFR 1.75(c), as allegedly being of improper dependent form for failing to further limit the subject matter of a previous claim.

The Examiner rejected claims 4 and 19 under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The Examiner rejected claims 1, 3, 7-9, 11, 17, 19-22, 24, 25, 27 and 28 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Deacon *et al.*, US Patent 5,792,269, in view of Mitani *et al.*, JP 3-281780 and Carpenter *et al.*, US Patent 6,821,347 B2.

The Examiner rejected claim 4 under 35 U.S.C. § 103(a) as allegedly being unpatentable

over Deacon *et al.*, Mitani *et al.*, and Carpenter *et al.*, as applied to claims 1, 3, 7-9, 11, 17, 19-22, 24, 25, 27 and 28 above, and further in view of Plavidal *et al.*, US Patent 5,718,795.

The Examiner rejected claim 6 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Deacon *et al.*, Mitani *et al.*, and Carpenter *et al.*, as applied to claims 1, 3, 7-9, 11, 17, 19-22, 24, 25, 27 and 28 above.

The Examiner rejected claims 23, 26 and 29 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Deacon *et al.*, Mitani *et al.*, and Carpenter *et al.*, as applied to claims 1, 3, 7-9, 11, 17, 19-22, 24, 25, 27 and 28 above, and further in view of Sasaki *et al.*, US Patent 6,685,848 B1.

Applicants respectfully traverse the claim objections, and both the § 112 and § 103 rejections, with the following arguments.

Claim Objections

The Examiner objected to claims 21, 22, 25 and 28 under 37 CFR 1.75(c), as allegedly being of improper dependent form for failing to further limit the subject matter of a previous claim. The Examiner argues: "The claims all depend on claim 1 and require a first fluid feed line is connected to a first source of a first fluid that supplies the first channels N_1 , and a second fluid feed line is connected to a second source of a second fluid that supplies the second channels N_2 . Claim 1 requires this same structure, therefore claims 21, 22, 25, and 28 fail to limit claim 1 from which they depend."

In response, have canceled claim 21, and have deleted from claims 22, 25, and 25 the language that the Examiner has objected to, namely the language: "wherein the first fluid feed line is connected to the source of the first fluid, wherein the second fluid feed line is connected to the source of the second fluid".

Applicants have also amended claim 1 to recite the language of canceled claim 21, which is alleged by the Examiner to be required by claim 1 and to therefore not further limit claim 1.

Applicants have also amended claim 22 to depend from claim 1 instead of from claim 21, since claim 21 has been canceled..

35 U.S.C. § 112, Second Paragraph

The Examiner rejected claims 4 and 19 under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The Examiner argues: "Clams 4 and 19 recite the limitations "the first plurality of channels" and "the second plurality of channels". There is insufficient antecedent basis for this limitation in the claims."

In response, Applicants respectfully contend that claim 4 does not contain the limitations "the first plurality of channels" and "the second plurality of channels". Therefore, claim 4 is not unpatentable under 35 U.S.C. § 112, second paragraph.

Applicants respectfully believe that the Examiner intended to reject claim 3 rather than claim 4 under 35 U.S.C. § 112, second paragraph.

Accordingly, Applicants have amended claims 3 and 19 to clarify the invention in consistency with the Examiner's arguments.

35 U.S.C. § 103(a)

Claims 1, 3, 7-9, 11, 17, 19-22, 24, 25, 27 and 28

The Examiner rejected claims 1, 3, 7-9, 11, 17, 19-22, 24, 25, 27 and 28 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Deacon *et al.*, US Patent 5,792,269, in view of Mitani *et al.*, JP 3-281780 and Carpenter *et al.*, US Patent 6,821,347 B2.

Applicants respectfully contend that claims 1 and 17 are not unpatentable over Deacon in view of Mitani and Carpenter, because Deacon in view of Mitani and Carpenter does not teach or suggest each and every feature of claims 1 and 17.

As a first example of why claims 1 and 17 are not unpatentable over Deacon in view of Mitani and Carpenter, Applicants maintain that Deacon in view of Mitani and Carpenter does not teach or suggest the following combination of features:

“wherein the I rings are denoted as R_1, R_2, \dots, R_i in order of increasing distance from the common point and consist of I_1 rings of a first type and I_2 rings of a second type, ...

wherein the I rings collectively comprise N channels, ...

wherein the N channels consist of N_1 channels of a first kind within the I_1 rings of the first type and N_2 channels of a second kind within the I_2 rings of the second type, ...

wherein each channel of the N_1 channels of a first kind is configured to provide a first fluid to flow into the chamber at a constant angle θ_1 with respect to an exposed surface of the distribution plate,

wherein each channel of the N_2 channels of the second kind is configured to provide a second fluid to flow into the chamber at a constant angle θ_2 with respect to the exposed surface of the distribution plate, ...

wherein the first fluid differs from the second fluid” (emphasis added).

The primary reference of Deacon has only one fluid feed line labeled "GAS/RF" in Deacon, FIG. 2. Therefore Deacon is incapable of having channels of a first kind configured to provide a first fluid flow of a first fluid into the chamber and channels of second kind configured to provide a second fluid flow of a second fluid into the chamber subject to the constraint of the first fluid differing from the second fluid.

The Examiner argues that Deacon could be modified to comprise independent fluid feeds to provide the claimed first and second fluids to respective first and second channels of the distribution plate, as taught by Mitani. However, the Examiner has not provided motivation for modifying Deacon to feed two different fluids into respective channels in the distribution plate. Thus, the Examiner has not established a *prima facie* case of obviousness in relation to claims 1 and 17.

Applicants next demonstrate that it is not obvious to modify Deacon to use a first fluid and a second fluid subject to the constraint of the first fluid differing from the second fluid.

The Examiner has cited Mitani (Figures 1 and 2 and Working Example 1) as disclosing an independent supply of two different fluids, namely WF_6 and SiH_4 which react chemically after passing through respective channels of the distribution plate to form W, wherein the W deposits as a film on a silicon substrate. See Mitani, page 5, bottom line - page 6, line 2.

As to motivation for modifying Deacon by the teaching of Mitani, the Examiner argues: "The motivation for adding the grooves of Mitani et al to the apparatus of Deacon et al is to independently supply process gases to prevent the fluids from premixing and to independently control the flow of fluid in each groove to optimize the gas distribution as taught by Mitani et al."

In response, Applicants do know why the Examiner has referred to reference numerals 22 and 23 in Mitani as representing "grooves". Mitani describes reference numerals 22 and 23 each as a "feeding hole group" which Applicants interpret to be an annulus (see Mitani, FIG. 2) comprising feeding holes. Mitani does not anywhere disclose that the feeding hole groups 22 and 23 consist of or comprise one or more grooves. Applicants respectfully request that the Examiner explain why the Examiner interprets feeding hole groups 22 and 23 as grooves.

In further response, Applicants note that the preceding argument by the Examiner is not persuasive because Deacon only uses a single gas species and therefore never encounters the problem of not having an optimized gas distribution of two different gas components. In other words, the Examiner is invoking Mitani to solve a problem that exists in Mitani but does not exist in Deacon, because Mitani is using two different fluids that need to be supplied in a controlled manner relative to each other, and Deacon only has one feed for only one fluid which is all that Deacon needs. Thus, the Examiner's reason for modifying Deacon by the teaching of Mitani is inapplicable to Deacon and accordingly not persuasive. The Examiner has still not provided any motivation for feeding two different fluids into respective channels in the distribution plate, inasmuch as Deacon does not require or even use two different fluids.

Furthermore, Applicants offer the following argument as to why it is not obvious to modify Deacon as done in Mitani: by feeding two different fluids (WF_6 and SiH_4) into respective channels in the distribution plate, followed by chemically reacting the two fluids (WF_6 and SiH_4) to form a reaction product (W) that deposits on the wafer.

Deacon's identifies the unsolved problem in the prior art of being unable to deposit a layer of insulating material (e.g., silicon dioxide) on a silicon wafer in manner that provides good

sidewall coverage (i.e., deposition) of the insulating material on sidewalls of metal lines on the wafer (see Deacon, col. 1, line 10 - col. 2, line 67). Deacon identifies unsuccessful attempts in the prior art to solve the aforementioned problem relating to obtaining good sidewall coverage (see Deacon, col. 3, lines 1-9).

Deacon's invention is specifically directed to solving the aforementioned problem of obtaining good sidewall coverage. Deacon's method flows gas to the distribution plate at angles other than ninety degrees and has demonstrated by testing that improvements in sidewall coverage of up to 35% are obtained through use of Deacon's novel method. See Deacon, col. 3, lines 12-45.

Therefore, any modification of Deacon that does not provide sidewall coverage at least as good as is obtained in the unmodified Deacon invention is not obvious.

Applicants assert that if Deacon were to be modified as is done in Mitani: i.e., by feeding two different fluids into respective channels in the distribution plate, followed by chemically reacting the two fluids to form a reaction product that deposits on the wafer, there is no evidence of record allegedly showing that good sidewall coverage would be achieved. In particular, the Examiner has not offered any evidence allegedly demonstrating that the reaction product (e.g., W) would provide sidewall coverage at least as good as is obtained in the unmodified Deacon invention.

Deacon demonstrated good sidewall coverage by testing Deacon's usage of a single fluid directed at an angle less than 90 degrees with respect to the surface of the wafer. No such test data, or any other evidence, is available for Mitani's reaction product or for any other reaction product. The ability of the reaction product to provide good sidewall coverage depends on many

factors (e.g., the energy distribution and the angular distribution of the reaction product, of which no information has been presented by the Examiner) and there is no way to know whether good sidewall coverage will be obtained with the reaction products through use of Deacon's invention without confirming test data. No such test data has been placed in evidence by the Examiner. Therefore, it is not obvious to modify Deacon as done in Mitani: by feeding two different fluids into respective channels in the distribution plate, followed by chemically reacting the two fluids to form a reaction product that deposits on the wafer.

Therefore, Deacon in view of Mitani and Carpenter does not disclose the preceding feature of claims 1 and 17.

As a second example of why claims 1 and 17 are not unpatentable over Deacon in view of Mitani and Carpenter, Applicants maintain that Deacon in view of Mitani and Carpenter does not teach or suggest the feature: "wherein the I rings are denoted as R_1, R_3, \dots, R_5 **in order of increasing distance from the common point** and consist of I_1 rings of a first type and I_2 rings of a second type" (emphasis added).

The Examiner argues that the distribution plate in Deacon, FIG. 19 comprises circular rings R_1, R_3 , and R_5 facing radially outward, and circular rings R_2, R_4 , and R_6 facing radially inward.

In response, Applicants assert that in Deacon, FIG. 19: (1) rings R_1 and R_2 appear to be at the same distance from the common point and Deacon does not disclose that ring R_2 is at a greater distance from the common point than is ring R_1 as required by claims 1 and 17; (2) rings R_3 and R_4 appear to be at the same distance from the common point and Deacon does not

disclose that ring R_4 is at a greater distance from the common point than is ring R_3 as required by claims 1 and 17; and (3) rings R_5 and R_6 appear to be at the same distance from the common point and Deacon does not disclose that ring R_6 is at a greater distance from the common point than is ring R_5 as required by claims 1 and 17.

Furthermore, rings R_1 and R_2 do not appear to be separate rings in Deacon, FIG. 19 (as required by claims 1 and 17) but instead appear to be within a same ring. Similarly, rings R_3 and R_4 do not appear to be separate rings in Deacon, FIG. 19 (as required by claims 1 and 17) but instead appear to be within a same ring. Similarly, rings R_5 and R_6 do not appear to be separate rings in Deacon, FIG. 19 (as required by claims 1 and 17) but instead appear to be within a same ring.

Therefore, Deacon in view of Mitani and Carpenter does not disclose the preceding feature of claims 1 and 17.

Based on the preceding arguments, Applicants respectfully maintain that claims 1 and 17 are not unpatentable over Deacon in view of Mitani and Carpenter, and that claims 1 and 17 are in condition for allowance. Since claims 3, 7-9, 11, 21-22, 24, 25, 27 and 28 depend from claim 1, Applicants contend that claims 3, 7-9, 11, 21-22, 24, 25, 27 and 28 are likewise in condition for allowance. Since claims 19 and 20 depend from claim 17, Applicants contend that claims 19 and 20 are likewise in condition for allowance.

Claim 4

The Examiner rejected claim 4 under 35 U.S.C. § 103(a) as allegedly being unpatentable

over Deacon *et al.*, Mitani *et al.*, and Carpenter *et al.*, as applied to claims 1, 3, 7-9, 11, 17, 19-22, 24, 25, 27 and 28 above, and further in view of Plavidal *et al.*, US Patent 5,718,795.

Since claim 4 depends from claim 1, which Applicants have argued *supra* to not be unpatentable over Deacon in view of Mitani and Carpenter under 35 U.S.C. §102(b), Applicants maintain that claim 4 is likewise not unpatentable over Deacon in view of Mitani and Carpenter, and further in view of Plavidal under 35 U.S.C. §103(a).

Claim 6

The Examiner rejected claim 6 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Deacon *et al.*, Mitani *et al.*, and Carpenter *et al.*, as applied to claims 1, 3, 7-9, 11, 17, 19-22, 24, 25, 27 and 28 above.

Since claim 6 depends from claim 1, which Applicants have argued *supra* to not be unpatentable over Deacon in view of Mitani and Carpenter under 35 U.S.C. §102(b), Applicants maintain that claim 6 is likewise not unpatentable over Deacon in view of Mitani and Carpenter under 35 U.S.C. §103(a).

In addition, Deacon in view of Mitani and Carpenter does not disclose the feature: “wherein paths of the fluids through the distribution plate further comprises grooves and wherein a volume of the grooves is greater than a volume of the channels”.

The Examiner argues: “Deacon et al, Mitani et at, and Carpenter et at differ from the present invention in that they do not teach that the volume of the grooves is greater than a volume of the channels... The motivation for making the volume of the grooves larger than the volume that the channels is so that the grooves function as plenums to uniformly distribute the

fluids to each of the channels. Furthermore, it was held in *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), by the Federal Circuit that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. (Also see MPEP 2144.04 (IV)(A))... Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the grooves of Deacon et al, Mitani et al, and Carpenter et al with a larger volume than the volume of the channels.”

In response, Applicants note that the Examiner has erroneously referred to feeding hole groups 22 and 23 of Mitani, Figure 2 as “grooves”, as explained *supra* in connection with Applicant’s arguments for claims 1 and 17.

If the Examiner insists that feeding hole groups 22 and 23 of Mitani are grooves and can explain why, then Applicants request that the Examiner identify in Mitani, Figure 22 what physically is the groove and groove volume, and what physically are the channels and channel volume, so that Applicants can understand and evaluate the Examiner’s argument.

Thus, claim 6 is not unpatentable over Deacon in view of Mitani and Carpenter.

Claims 23, 26 and 29

The Examiner rejected claims 23, 26 and 29 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Deacon *et al.*, Mitani *et al.*, and Carpenter *et al.*, as applied to claims 1, 3, 7-9, 11, 17, 19-22, 24, 25, 27 and 28 above, and further in view of Sasaki *et al.*, US Patent 6,685,848

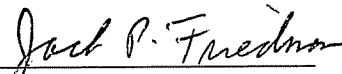
B1.

Since claims 23, 26, and 29 depend from claim 1, which Applicants have argued *supra* to not be unpatentable over Deacon in view of Mitani and Carpenter under 35 U.S.C. §102(b), Applicants maintain that claims 23, 26, and 29 are likewise not unpatentable over Deacon in view of Mitani and Carpenter, and further in view of Sasaki under 35 U.S.C. §103(a).

CONCLUSION

Based on the preceding arguments, Applicants respectfully believe that all pending claims and the entire application meet the acceptance criteria for allowance and therefore request favorable action. If the Examiner believes that anything further would be helpful to place the application in better condition for allowance, Applicants invites the Examiner to contact Applicants' representative at the telephone number listed below. The Director is hereby authorized to charge and/or credit Deposit Account 09-0456 (IBM).

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